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Prevention of Prematurity and the Care of Premature Infants

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The Prevention of Prematurity and the care of Premature Infants

1. According to international definition a premature infant is one which weighs at birth 5½ lbs. (2,500 gm.) or less, irrespective of tbe estimated period of gestation.

2. At present, prematurity, or conditions associated with it, account together for over 5,500 registered infant deaths annually in England and Wales. Nearly 60 per cent. of first week infant deaths occur in premature infants. 54 per cent. of 15,403 stillbirths notified in 1959 were premature which shows the close relationship with prematurity either as a primary or secondary factor.

3. It is often a matter of chance whetber an infant is horn dead or dies soon after birth so that it is desirable to examine pre-natal, intra-natal and early neonatal deatbs as a single prohlem. The perinatal mortality rate calculated hy taking stillbirths and deaths occurring during the first week of life and expressing their frequency as a ratio per 1,000 live and stillbirths was 34 per 1,000 in England and Wales in 1959 and is too high. If it could he reduced to that ohtaining in, say, Sweden in 1955 of 28 per 1,000 live and stillbirths some 5,000 infant lives would be saved annually. Since prematurity plays such an important part in causing perinatal mortality the only way to reduce it suhstantially is by finding and using methods of preventing prematurity, and hy conserving the lives of infants born prematurely.

A Review of the Present State of Knowledge of Prematurity

Frequency

4. In England and Wales in 1959, 58,648 births or 7·7 per cent. of all notified births were premature, 6·7 per cent. of notified live births representing 50,310 infants and 54 per cent. of notified stillhirtbs or 8,338 stillhorn infants were premature. 38,742 live premature infants horn in institutions represented 8 per cent. of notified institutional live births in 1959.

Degree

5. Of all liveborn premature infants, 51 per cent. weigh from over 4 lbs. 15 ozs. to 5 lhs. 8 ozs.; 20 per cent. weigh from over 4 lbs. 6 ozs. to 4 lbs. 15 ozs.; 29 per cent. weigh 4 lbs. 6 ozs. or less and 11·5 per cent. fall into the category of 3 lhs. 4 ozs. or less.

Factors determining Incidence

6. The incidence of prematurity is influenced by sex, race, illegitimacy, social class, hirth order, age of mother and such abnormalities of pregnancy as toxaemia, ante-partum baemorrhage and multiple pregnancy.

Aetiology and Causes of Mortality

7. The cause of premature labour is unknown in ahout 50 per cent. of cases. In the remainder the most important associated conditions are toxaemia, ante-partum haemorrhage and multiple pregnancy.

8. Recently, bowever, considerahle progress has been made in recognising specific causes of perinatal death. Bound et al. defined the causes of death in 157 necropsies performed on premature newhorn infants at the University College Hospital, London, hetween 1948 aud 1955. Claireaux's investigations

concerned an analysis of neonatal deaths in premature infants in Queen Charlotte's Hospital, London, from 1948-1955 inclusive. In both series it was shown that disorders of the respiratory system accounted for most of the deaths. The next important condition was intraventricular haemorrhage.

9. As contrasted with full-time infants, premature infants suffer from handicaps arising out of the underdeveloped state of important organs or functions at the time of birth. Perhaps the least well developed organs for the function they will require to perform after birth are the lungs. Primary atelectasis or failure of the lungs to expand, and secondary atelectasis or collapse of the lungs after initial expansion, commonly occur. The exceptional liability of the cranium to distortion during parturition, the fragility of the intracranial blood vessels, and the relatively low concentration of prothrombin in the hlood combine to create increased risk of cerehral birth trauma and intracranial haemorrhage. The surveys of Bound and Claireaux already mentioned confirm the importance of those factors. Other factors are:

(i) Immaturity of the liver causing hyperbiliruhinaemia and the consequent risk of kernicterus.

(ii) The poor heat-regulating mechanism of premature infants so that they are easily over- or under-heated.

(iii) The immaturity of the digestive system.

(iv) Susceptibility to infection.

10. Certain therapeutic procedures may be related to kernicterus or prematurity. Crosse (1955) and Laurance (1955) found that large dosage of vitamin K administered to the infant was related to kernicterus. Premature infants who received prophylactic doses of penicillin and sulphafurazole were reported by Silverman et al. (1956) to develop kernicterus and to have a raised death rate.

Mortality

II. *Table showing Deaths within 24 hours and Survivors at 28 days by Weight Groups of Notified Premature Live Births in England and Wales* 1959

Weight	Number	Proportion per 100 Live Premature Infants	Deaths in 24 hours		Survivors at 28 days	
			Number	Per 100 Live Premature Infants	Number	Per 100 Live Premature Infauts
—3 lbs. 4 ozs. or 1,500 gms.	5,789	11·5	2,672	46	1,953	34
—4 lbs. 6 ozs. or 2,000 gms.	8,783	17·5	877	10	7,170	81·5
—4 lbs. 15 ozs. or 2,250 gms.	10,197	20	320	3	9,469	93
—5 lbs. 8 ozs. or 2,500 gms.	25,541	51	400	1·5	24,571	96
All cases	50,310	100	4,269	8	43,163	86

*The minus sign of the weight group is to be interpreted as follows:
"—3 lbs. 4 ozs." means up to and including 3 lbs. 4 ozs.
"—4 lbs. 6 ozs." means over 3 lbs. 4 ozs. up to and including 4 lbs. 6 ozs. and so on.

The rate of survival of premature infants is directly proportional to the birth weight. The table shows that the first day of life is the most dangerous period, especially for those in the lowest weight groups; nearly one half of the infants weighing 3 lbs. 4 ozs. or less died within twenty-four hours of birth.

Prognosis

12. It can justifiably be said that the prognosis for premature infants in the higher weight groups is excellent. Studies by Dann, Levine and New (1958) and Drillien (1958) suggest that among the premature infants of very low birth weight there will be a relatively high proportion of babies who have permanent defects. Crosse (1957) states that in the absence of congenital malformation and of cerebral damage, and if allowance is made for the degree of prematurity, the development of premature infants is generally not inferior to that of full-time children. The achievements of others are also encouraging. Hess (1953) in a thirty-year study of premature infants with birth weights of $2\frac{3}{4}$ lbs. or less found that of 370 infants known to be alive 85 per cent. had developed normally. But his figures, although derived from the largest series and longest follow up, must be compared with other workers showing a much greater incidence of defects. Drillien (1958) in a part-controlled study of sixty-nine children weighing 3 lbs. or less at birth whose ages ranged from six months to nine years at the final medical examination states that at least two-thirds of these infants sustained physical, mental or emotional handicaps of varying severity in later infancy and childhood. Whatever the statistical assessment may be the expenditure of effort and time will save many premature infants and will help them to become normal healthy individuals.

Available Facilities

13. An enquiry into the facilities available for the hospital and home care of premature infants was carried out by questionnaire in England and Wales in 1956. One hundred and forty-six local health authorities and 377 hospitals participated. It was evident from the returns that there exists a wide variation in nursery accommodation and equipment of premises, medical supervision, status and experience of nursing staff engaged in premature baby care, arrangements for resuscitation of infants in hospital and in the home, and transport provision. Only 45 per cent. of infants in the lowest weight group, i.e. 3 lbs. 4 ozs. or less, nursed in hospital were admitted to specially equipped premature baby units, staffed by midwives and nurses with special training and experience engaged full time in the work.

A Comprehensive Programme for Premature Infants

14. A comprehensive premature baby care programme designed to rectify existing deficiences and to raise the general standard of care would seem timely. A complete programme would include measures to reduce the incidence of premature births, an integrated scheme to cover all aspects of hospital and home care of premature infants and an effective system of after-care.

15. Attention is particularly drawn to the advantages of combining the hospital care of premature infants with that of mature sick newborn infants who require similar expert care and supervision. Special baby care units attached to large and medium-sized maternity departments which would admit mature infants suffering from birth injury, asphyxia, haemolytic disease of the newborn, babies of diabetic mothers, etc. as well as premature infants are strongly favoured. Great care should be taken to avoid introducing infection into these special units.

The Prevention of Prematurity

16. Since knowledge of the aetiology of prematurity is far from complete, the possibilities of prevention are limited, but from the factors known to influence the incidence it is clear that the quality of ante-natal care is an important element in the prevention of premature birth. The expectant mother's health has a direct bearing on the survival of the infant and this points the need for all women to have a full medical examination which should include haemoglobin estimation and other recognised blood tests very early in pregnancy and regular and thorough ante-natal supervision. A fundamental requirement is careful selection of cases for hospital confinement. Selection should be made after assessment of the physical signs and history including previous miscarriages, premature births and stillbirths. The significance of age, parity, multiple pregnancy and the vulnerability of certain social class groups should be taken into account. An adequate number of ante-natal beds should be available for hospital treatment, even at the expense of lying-in beds. Conditions to keep in mind in this regard are early toxaemia, ante-partum haemorrhage and multiple pregnancies. Pre-eclampsia and ante-partum haemorrhage call for specialist obstetric care and admission to hospital. Bed rest for patients with multiple pregnancy between the thirty-second and thirty-sixth weeks is advocated by many obstetricians. The relationship between birth weight and probability of survival is an important consideration in deciding on induction of labour. It is important to make certain that the ante-natal patient clearly understands the advice given to her and that it is possible for her to put it into practice. It is often not enough to give advice, it is essential to check that it is being carried out.

Organisation of Special Baby Care Facilities

17. Facilities would include the establishment of special baby care units by the hospitals for prematures and other infants requiring similar facilities as well as satisfactory domiciliary premature baby care and effective transport schemes by local health authorities. *Special Baby Care Units* should be provided only in large and medium-sized maternity departments catering for abnormal obstetrics, which should always have enough ante-natal beds as well as emergency beds reserved for unbooked cases of labour. The geographical location of the main obstetric departments and the uneven distribution of population may be limiting factors in planning, but it is preferable to concentrate institutional special baby care into one or two of the larger maternity departments rather than have several small maternity departments each making its own arrangements. These specialist centres would accept patients in premature labour and premature and other infants from the district and from smaller maternity departments within a defined area. This means acceptance of the principle of transfer from one maternity department to another in the interests of the baby. Sympathetic consideration should always be given to the admission of the mothers of such infants if enough lying-in beds are available. The single rooms in the special baby care unit will usually be reserved for mothers who would be ambulant and not in need of midwifery nursing. Emergency resuscitation teams may operate from the specialist centres.

18. The *number of cots* which should be provided in a special baby care unit in a given area can be estimated from the number of live births, the incidence of prematurity and the proportion of live premature infants weighing 4 lbs. 8 ozs. or less at birth. For every 1,000 hospital and domiciliary total live births at least six cots for prematures and other sick newborn infants would be required

on an average of five weeks stay. For convenience of administration the optimum size of the unit would be not less than twenty cots, adequate to serve a population of 200,000. But geographical circumstances will sometimes justify a smaller unit providing tbe same facilities.

19. The consultant paediatrician in collaboration with the consultant obstetrician and the medical officer of bealth should be responsible for the co-ordination of hospital and home care. The area served by the specialist centre with its obstetric department and special baby care unit would need to be clearly defined. A leaflet giving details of the scbeme, including the transport arrangements, with clear instructions in the method of obtaining the services, should be available to all family doctors in the area and to the local health authority staff.

Hospital Special Baby Care

20. Premature infants weighing 4 lbs. 8 ozs. or less at birth and otber infants requiring special care have the best chance of survival under constant expert supervision in adequately equipped units staffed by whole-time specially trained and experienced nurses. The superiority of results obtained in large specialist units is evident in studies of premature baby care and of mortality figures of haemolytic disease of the newborn.

(*a*) *A special baby care unit* should be located in the main obstetric department in the area. It should be well designed and compact, and should include:

(1) A hot room or incubator room maintained at a temperature of 80°F. and not humidified, suitable for opening type incubators. Closed type incubators may be used in a cool room.

(2) Warm humidified room(s) with a temperature of 70°–75°F. and a relative humidity of 60%–65% for infants nursed in open cots.

(3) Cool room(s) 60°–65°F. in which infants become acclimatised to natural conditions before discharge.

(4) Observation or isolation rooms.

(5) A demonstration room.

(6) Milk kitchen with two sections: (1) for bottle cleansing and sterilisation and
(2) for food preparation.

(7) Clean utility room.

(8) Dirty utility room.

(9) Linen room.

(10) Duty room.

(11) Storage room for equipment.

(12) Room for resuscitation, transfusion, or other treatment.

(13) Single rooms for mothers according to the size of the unit, within the unit or accessible to it, witb the necessary ancillary rooms.

A minimum floor space of fifty square feet should be allowed for each cot and opening incubator and *thirty square feet* for each closed incubator; the maximum number of cots or incubators sbould be six in any room.

(*b*) *Medical Staff*

The management of labour and immediate medical care of the infant at birtb have an important bearing on tbe survival and development of the infant,

particularly if it is born prematurely. The consultant obstetrician and the consultant paediatrician have a joint interest and responsibility in promoting measures to reduce infant mortality and morbidity. A special baby care unit would be under the medical direction of the consultant paediatrician, who would work in close collaboration with the consultant obstetrician and his obstetric team. In the larger hospitals he would have the assistance of an experienced paediatric registrar. He would be responsible for the supervision of the unit, and be available for emergency consultation in the hospital and in the home.

(*c*) *Midwifery and Nursing Staff*

Skilled care and diligent supervision by midwifery and nursing staff who have had special training in this work under close paediatric control are indispensable for good special baby care. On account of the highly specialised character of the work a staffing ratio of at least two staff to three babies is recommended. The ratio of specially trained nurses to other nurses should be kept as high as possible, preferably one to one, and enough experienced staff should be on duty in the premature baby unit at all times during the day and night. Every effort should be made to interest staff in the care of the premature infant and to encourage them to take the necessary training. Refresher courses for staff engaged in special baby care should be arranged to stimulate interest and to keep their knowledge up to date.

(*d*) *Emergency Resuscitation Team*

Immediate resuscitation must be the responsibility of those on the spot, but they should be able to call upon a team from the specialist centre to take over the infant who clearly needs continued special care. The team should consist of the consultant paediatrician or an experienced member of his medical staff and a specially trained midwife or nurse, provided with transport and resuscitation equipment. It should be possible to summon these teams at any time during the day or night to other hospitals or to emergencies in the home.

(*e*) *Principles of Care*

All women in premature labour should, if time permits, be admitted to the area specialist centre to give them the advantages of skilled obstetric attention. The unique vulnerability of the small infant demands modified maternal analgesia and anaesthesia, and episiotomy. A heated cot and oxygen, with equipment for clearing the infant's airway, and for resuscitation, should be available. Management of asphyxia requires a prepared plan of action.

The handicaps of prematurity must be compensated by alteration in environment and other specific measures. As with other treatment the decision whether incubators and/or oxygen should be used rests with the paediatrician. If oxygen is used its concentration should always be strictly controlled by the use of oxymeters. An atmospheric oxygen concentration of 25 per cent. is adequate for most purposes and 35 per cent. should only be exceeded on medical advice in exceptional circumstances.

The premature infant is particularly prone to infection. It is essential to isolate any baby showing signs of a possible infection and any who have been exposed to infection in hospital or before admission. All necessary precautions should be taken to prevent airborne and contact with infection, and barrier nursing should be scrupulously practised. Because of the immaturity of the digestive system the feeding of the small infant requires special skill in tube feeding.

Charts giving the daily food requirements and methods of administration according to birtb weight and day of life may be used for general guidance in supplementing individual prescription, as in some units at present. The suitability of breast milk for the premature infant is widely acknowledged, and every effort should be made to obtain supplies if the mother cannot provide it herself.

(*f*) *Preparation for Discharge*

The welfare of the premature infant is closely related to the home conditions of the family and the competence of the mother, who should be instructed in the management of her baby. Discbarge of the infant should not be arranged until it is known tbat tbe home circumstances are suitable and tbat any necessary belp is available. There sbould always be consultation witb the family doctor and the medical officer of the local health authority, and a prior visit to the home by the special nurse or health visitor is usually necessary. In many cases the special nurse or health visitor may be able to visit the maternity department also. In all cases a full report of the medical condition of the infant, the feeding regime and tbe after-care and follow-up arrangements sbould be sent to the family doctor and the medical officer of healtb well before tbe infant's discharge from bospital.

Domiciliary Premature Infant Care

21. 12,730 premature births or 22 per cent. of all notified premature births took place at home in 1959. A progressive reduction in this percentage can be expected, by better selection of cases for hospital confinement and by admitting patients wbo go into premature labour to tbe specialist centre. It is, however, sometimes not possible, because of precipitate labour or refusal of the mother, to send women in premature labour to hospital. A domiciliary premature baby service should provide, wben required, immediate resuscitation for premature infants born at bome, and special care for larger infants fit to remain at home and for all infants wbo require special care on discbarge from hospital. It may sometimes be possible for the midwife and the general practitioner obstetrician to anticipate the need for the emergency resuscitation team when labour begins and to summon it. Wben the infant has been resuscitated the decision whetber it should remain at home depends partly on the birth weight, partly on the presence of any other medical indication, and partly on the quality of the bome. If transfer to the special unit is decided upon it sbould follow resuscitation immediately. Premature babies are very susceptible to cooling and should be kept warm. The nursing care of tbe premature infant in the bome should be undertaken in urban areas by a nurse or midwife with special training who has a small case load, so that sbe may be able to make frequent visits to the home. In rural areas the district nurse midwives wbo undertake this work as well as their other duties sbould bave additional training. A domiciliary care service should also include the provision of special equipment, domestic help if required, and medical supervision by tbe family doctor wbo will be able to call on a consultant paediatrician if necessary.

Transport of Premature Infants

22. 2,335 premature infants or 20 per cent. of all liveborn premature infants born at home were transferred to bospital in 1959. An arrangement by which all women wbo go into labour before the thirty-seventb week of pregnancy are sent to a pre-selected maternity department, the establishment of an emergency resuscitation team, and improved transport facilities would belp to reduce tbe mortality among the transported premature infants. Ambulances should be

heated and have a heated carrier with facilities for the administration of oxygen. A portable incubator is now availahle in which both temperature and oxygen concentration can be controlled. The baby should he accompanied by a nurse proficient in premature haby care. To avoid confusion precise information about the transport arrangements should be given in the leaflet outlining the general scheme so that each person will know exactly how to obtain the ambulance and who will supply the nurse escort and equipment.

After-care and Follow-up Schemes

23. Constant supervision, in view of the close relationship between high morhidity and mortality in the premature infant and the quality of maternal care, is the essence of good after-care. The supporting services of the local health authority, under the supervision of the family doctor, are particularly valuable. The most effective of these would be the care given hy the specially trained nurse or health visitor visiting the home, daily if necessary, during the six to eight weeks after discharge from the special unit and thereafter at least once weekly, until the consultant paediatrician and family doctor agreed that the hahy no longer needed special care. The advantages of such a scheme are that babies are not exposed to the risk of infection from contact with others outside the family, even at clinic or surgery; feeding prohlems are prevented or controlled by the advice given to the mother, and organic disorders are brought to medical attention at an earlier stage. There should he arrangements for the regular long-term follow up hy the consultant paediatrician of all premature infants horn in hospital and at home.

Research and Appraisal of Results

24. Since the aetiology of prematurity is unknown in more than one half of the cases it is clear that research on the factors causing premature lahour is urgently needed. Prospective studies of successive pregnancies started early in pregnancy and carried on throughout labour and the puerperium, with regular long-term follow up of the mother and her children, would be of value. Such studies would help in understanding social and hiological influences and the immediate and remote effects of specific episodes in early pregnancy. A perinatal mortality committee consisting of consultant obstetricians, consultant paediatricians, pathologists, medical officers of health, family doctors and senior midwives or nurses, in the area served hy the hospital might review perinatal deaths with the ohjects of defining causes and assessing avoidahility. The seriousness of asphyxia and atelectasis as a cause of death in the premature infant is well recognised; the prevention and treatment of these conditions might usefully he considered hy the committee.

25. Appraisal of early and late results of premature hahy care is of particular importance and requires accurate statistics. The correct hirth weight should he recorded for all notified hirths including stillbirths. The medical officer of health who is responsihle for compiling statistics relating to premature births might hring to the notice of others concerned the yearly incidence and survival rates and also give the causes of perinatal deaths, as far as information is available, in his annual report.

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